CHMG-142 Name(s): Alex Iacob

Dissociation constants of acids:

HOAc Ka=1.78x10-5

H2SO4 Ka1=1x107 Ka2=1.0x10-2

HCNO Ka=2x10-4

H2CO3 Ka1=4.3x10-7 Ka2=5.6x10-11

H2O Ka=1.0x10-14

HIO Ka=2.3x10-11

HIO3 Ka = 1.7x10-4

HCl Ka=1x108

HNO3 Ka=1x106

HF Ka = 3.5x10-4

H2C2O4 Ka1 = 6.0x10-2 Ka2 = 6.1x10-5

Dissociation constants of bases:

NH3 Kb=1.76x10-5

CH3NH2 Kb=4.4x10-4

HONH2 Kb=1.1x10-8

C2H5NH2 Kb = 5.6x10-4

I mix together 50.0 mL of 0.100 M NaIO3, 50.00 mL of 0.100 M NaOH, and 10.0 mL of 0.100 M HIO3. What is the pH of the mixture?

Piece #1 What is HIO3?

Acid

Piece #2 What is NaOH?

Salt

Piece #3 What is NaIO3?

Salt

Piece #4 Dissociate all of the salts into their ions.

NaIO3 = Na+ + IO3-

NaOH = Na+ + OH-

Piece #5 Make a list of all the acids.

HIO3

Na+

H2O

Piece #6 Make a list of all the bases.

OH-

IO3-

H2O

Major breakthrough #1. Write a balanced reaction for the reaction of EACH acid with EACH and every base.

* 1. HIO3 + OH- ⬄ H2O + IO3 -
  2. HIO3 + IO3- ⬄ HIO3 + IO3-
  3. HIO3 + H2O ⬄ H3O+ +IO3 -
  4. Na+ + OH- ⬄ NaOH
  5. Na+ + IO3- ⬄NaI + O3
  6. Na+ + 2 H2O⬄ NaOH + H3O+
  7. H2O + OH- ⬄ H2O + OH-
  8. H2O + IO3- ⬄ HIO3 + OH-
  9. H2O + H2O ⬄ OH- + H3O+

Major Breakthrough #2 For each reaction you wrote, determine the equilibrium constant (K) or the relative value of it (SFB, FB, etc.)

1. SFB
2. K = 1
3. K = 1.7 x 10 -4
4. K = 0
5. K = 0
6. K = 0
7. K = 1
8. K = 5.9 x 10 -11
9. K = 1 x 10 -14

Finally, some math #1 Determine the DILUTED concentration of HIO3 in the mixture before any acid/base reaction has occurred.

M1V1 = M2V2

0.100 M \* 10 mL = M2 \* (110 mL)

0.0091 M = M2

Finally, some math #2 Determine the DILUTED concentration of Na+ in the mixture before any acid/base reaction has occurred.

M1V1 = M2V2

0.100 M \* 50 mL = M2 \* (110 mL)

0.0455 M = M2

Finally, some math #3 Determine the DILUTED concentration of IO3- in the mixture before any acid/base reaction has occurred.

M1V1 = M2V2

0.100 M \* 50 mL = M2 \* (110 mL)

0.0455 M = M2

Finally, some math #4 Determine the DILUTED concentration of OH- in the mixture before any acid/base reaction has occurred.

M1V1 = M2V2

0.100 M \* 0.05 L = M2 \* (0.110 L)

0.0455 M = M2

Let’s make a picture #1 For the reaction with the BIGGEST K, construct an ICE chart.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | HIO3 | OH- | ⬄ | H2O | IO3 - |
| I | 0.0091 M | 0.0455 M |  | 0 M | 0.0455 M |
| C | - x | - x |  |  | + x |
| E | 0.0091 - x | 0.0455 - x |  | 0 | 0.0455 + x |

LET’S DO IT! #1 Solve the ICE chart for the reaction with the BIGGEST K.

Kc = (0.0455 + x) / ((0.0091 - x) \* (0.0455 - x))

x = -0.0455

Let’s make a picture #2 For the reaction with the second BIGGEST K, construct an ICE chart using the concentrations as they exist AFTER the first reaction is over.

LET’S DO IT! #2 Solve the ICE chart for the reaction with the second BIGGEST K.

Repeat until the ICE charts stop yielding any significant change.

DONE! DONE! DONE! #1

I mix together 50.0 mL of 0.100 M NaIO3, 50.00 mL of 0.100 M NaOH, and 10.0 mL of 0.100 M HIO3. What is the pH of the mixture?

I didn’t really understand how to achieve the answer using molarity, so I am going to use moles.

Moles of HIO3: M = n / V -> 0.100 M = n / 0.01 L => n = 0.001 moles

Moles of NaOH: M = n / V -> 0.100 M = n / 0.005 L => n = 0.005 moles

Moles of NaIO3: M = n / V -> 0.100 M = n / 0.005 L => n = 0.005 moles

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | HIO3 | NaOH | ⬄ | H2O | NaIO3 |
| I | 0.001 mol | 0.005 mol |  | 0 mol | 0.005 mol |
| C | -0.001 mol | -0.001 mol |  | 0 | +0.001 mol |
| E | 0 mol | 0.004 mol |  | 0 mol | 0.006 mol |

M = 0.004 mol / 0.110 L = 0.0364 M

pOH = -log[OH-] -> -log(0.0364) -> - (-1.4389) = 1.44 -> 14 – 1.44 = 12.56

The pH of the mixture is **12.56**.